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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/055,580	01/22/2002	Jin-Yuan Lee	085027-0060	6089

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EXAMINER	
MITCHELL, JAMES M	

ART UNIT	PAPER NUMBER
2813	

NOTIFICATION DATE	DELIVERY MODE
08/23/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SIP_Docket@mwe.com

Office Action Summary	Application No.	Applicant(s)	
	10/055,580	LEE ET AL.	
	Examiner	Art Unit	
	JAMES M. MITCHELL	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 May 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *See Continuation Sheet* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *92,97,99,101,104,106-109,118,120-123,125-129,151,152,154 and 156-172* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Disposition of Claims: Claims pending in the application are 92,97,99,101,104,106-109,118,120-123,125-129,151,152,154 and 156-172.

DETAILED ACTION

1. This office action is in response to applicant's amendment filed May 26, 2010.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 92, 97, 101, 104, 106, 107, 109, 118, 120-123, 126-129,163, 166-172 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. 6,013,571) in combination with Wu et al. (U.S. 6,459,150) and Ohuchi (U.S. 2002/0033525).

5. Morrell (e.g. Fig. 3, 4) discloses:

(cl. 92, 120, 165) A substrate (14) comprising a first pad (32) having a surface with a first (e.g. left portion), second (e.g. right portion) and third region (e.g. center) between the first and second regions, and a bonding structure on a chip (12) comprising a pad

(16) having a top surface (e.g. plane mechanically contacting 50) with a fourth region (e.g. left portion, 16, under 46), a fifth region (e.g. right portion, 16, under 46), and a sixth region between said fourth and fifth (e.g. center portion contacting 20) and over the pad, and a passivation/ separating layer (46) on (e.g. covering) said fourth and fifth regions, a metal layer (50) on said third region, over (e.g. above) said passivation layer and over said fourth and fifth regions; a copper pillar (24; Col. 2, Line 16-19) on said metal layer, over said passivation/ separating and over said fourth and fifth regions, wherein said sixth region is at a top of a second opening in the pasivation layer (e.g. opening in said passivation exposes said sixth region); a copper pillar (24) between sixth region and said first pad, wherein said copper pillar is connected to said sixth region through said second opening and to said first pad, said metal metal layer (50) is between copper (24) and said sixth region (opening in 46 exposing pad, 16) between copper pillar and said passivation , between said copper and said first region and between said copper and said second region (Fig. 3), wherein said pillar is connected through said metal layer, a tin containing cap/layer (30; Col. 3, Lines 51-53 & 65-66) over said copper pillar; said copper pillar has a thickness[1] (e.g. top to bottom of 24) greater than a distance between said copper pillar[2] and said third region (e.g. left to right greater than top of 34 to bottom 3; Fig. 2);

(cl. 101) with a conductive layer (162) between the cap and copper pillar wherein vertical thickness of pillar (e.g. vertical from top to bottom) greater than a thickness of the conductive layer (e.g. top to bottom) ;

[1] Alternatively could be from left to right.

(cl. 104) the tin cap has a melting point less than copper (e.g. its solder)

(cl. 106, 123) the metal layer comprises titanium (Col. 3, Lines 1-8) between copper and contact point;

(cl. 107, 127) metal layer comprises titanium-tungsten (col. 3, Lines 1-5);

(cl. 109, 128) where metal layer comprise copper (Col. 3, Lines 1-5);

(cl. 118, 121) wherein tin is directly on said copper pillar (28 on 24);

(cl. 121) said tin cap is directly on said copper pillar (Fig. 3);

(cl. 126) a conductive layer (162) between said copper pillar and tin cap (e.g. 130) wherein a second vertical thickness is greater than a third vertical thickness of the conductive layer;

(cl. 129) the tin cap has a melting point less than that of said copper pillar (Col. 4, Lines 4, Lines 1-3).

6. Morrell does not appear to show explicit use of a solder mask that it tin cap comprised silver or copper, or that the pillar has a width and thickness greater than the an opening and depth or opening in solder mask, or use of an underfill.

7. However, Wu teaches use of a solder mask (86).

8. It would have been obvious to one of ordinary skill in the art to modify the substrate of Morrell to include a mask in order to protect the substrate an insulate pads as taught by Wu (Col. 8, Lines 43-45) therefore forming a vertical distance betewwn bottom of copper pillar and top of solder mask .

9. Ohuchi discloses use of an undefill (4).

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[2] No definite location along pillar given as staring point to measure distance from.

It would have been obvious to one of ordinary skill in the art to incorporate use of an underfille to the package of modified Morrell in order to mitigate stress as taught by Ohuchi (Abstract)

With respect to the cap, Morrell discloses the same invention as claimed except that its tin cap comprises lead instead of silver or copper. Ohuchi (Par. 0044) shows that Sn/Pb and Sn/ Ag produce equivalent structures known in the art. Therefore, because these materials are art recognized equivalents at the time the invention was made, one of ordinary skill in the art would have found it obvious to substitute Sn/Ag for Sn/Pb.

10. Furthermore, Sn/ Ag is a known material for providing eutectic solders as exemplified by Ohuchi (Par. 0044). As such, it would have been obvious to one of ordinary skill in the art to select Sn/Ag as an alternate eutectic solder, since it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination. Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

11. With respect to claim 92,122 and 172 that the cap has a thickness across axis of the body and therefore a traverse dimension less than that of the copper pillar and various selected thicknesses/ dimensions of other claims, applicant has not disclosed that the selected dimension is for a particular unobvious purpose, produces an unexpected result, or is otherwise critical. As such, the selected dimension would have been obvious to one of ordinary skill in the art, since it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations

are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

12. With respect to the process limitation of claims 97 and 163 that the copper is electroplated that the pillar has a width and thickness greater than an opening and depth or opening in solder mask,modified prior art forms the same structure as claimed. Although Morrell discloses plating of its pillar (Col. 3, Lines 24-26), claim 163 is a product-by-process therefore patentability does not depend on its process. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

13. Claims 99 and 165 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. 6,013,571), Wu et al. (U.S. 6,459,150) and Ohuchi (U.S. 2002/0033525) as applied to claims 92 and 120 and further in combination with Hozoji et al. (U.S. 2002/0079575).

14. Neither Morrell nor Ohuchi appear to disclose it solder material being tin comprising copper.

15. However, Hozoji teaches use of bumps of tin comprising copper to mount chips (Par. 0104).

16. TiN comprising copper is a known material for connecting chips as exemplified above. As such, its selection would have been obvious to one of ordinary skill in the art, since it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination. Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

17. Claims 108 and 125 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. 6,013,571), Wu et al. (U.S. 6,459,150) and Ohuchi (U.S. 2002/0033525) as applied to claims 92 and 120 and further in combination with Fang (U.S. 2002/0095784).

18. Neither Morrell nor Ohuchi disclose that its metal layer is chromium.

19. Fang teaches use of chromium metal layer ("UBM"; 308; Par .0029).

20. Because use of chromium is known in the art for providing underlying metal layers, it would have been obvious to one ordinary skill in the art to select the claimed material, since it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination. Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

21. Claims 151, 152, 154, 157, 159-162 and 164 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. 6,013,571).

22. Morrell (e.g. Fig. 3, 4) discloses elements from paragraph 5 of this office action including:

(cl. 151) A bonding structure on a chip comprising a pad (16) having a top surface (e.g. plane mechanically contacting 50) with an alternate first region[3] (e.g. left portion, 16, under 46), an alternate second region (e.g. right portion, 16, under 46), and alternate third region between said first and second regions (e.g. center portion contacting 20), and a passivation layer (46) on (e.g. covering) said first and second regions, wherein an opening in said passivation layer is over said third region and exposes said third region: a metal layer (50) on said third region, over (e.g. above) said passivation layer and over said first and second regions; a copper pillar (24; Col. 2, Line 16-19) on said metal layer, over said passivation and over said first and second regions; over said pad; and a tin containing cap (30; Col. 3, Lines 51-53 & 65-66) over said copper pillar; said cap having a first vertical thickness less than a second vertical thickness of said copper pillar (e.g. Fig. 3);

(cl. 152) said tin cap contacts (e.g. Fig. 3);

(cl. 154, 167, 170) the metal layer comprises titanium (Col. 3, Lines 1-8);

[3] Applicant can be his own lexicographer. Pads can be broken into however many section one wants or call them whatever name one chooses (e.g. A, B, C, 1st, 6th etc.).

(cl. 159) a conductive layer (162) between said copper pillar and tin cap (e.g. 130) wherein a second vertical thickness is greater than a third vertical thickness of the conductive layer;

(cl. 160) the metal layer comprises titanium-tungsten (Col. 3, Lines 1-8);

(cl. 157, 161) the metal layer comprise copper (Col. 3, Lines 1-8);

(cl. 162) the tin cap has a melting point less than that of said copper pillar (Col. 4, Lines 1-3).

23. With respect to claim 151 that the cap has a thickness across Y axis of the body and therefore a traverse dimension less than that of the copper pillar, applicant has not disclosed that the selected dimension is for a particular unobvious purpose, produces an unexpected result, or is otherwise critical. As such, the selected dimension would have been obvious to one of ordinary skill in the art, since it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

24. With respect to the process limitation of claims 163 and164 that the copper is electroplated, the prior art forms the same structure as claimed. Although Morrell discloses plating of its pillar (Col. 3, Lines 24-26), claim 163 is a product-by-process therefore patentability does not depend on its process. "[E]ven though product-by-

process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

25. Claim 156 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. 6,013,571) as applied to claim 151 and further in combination with Fang (U.S. 2002/0095784).

26. Morrell does not disclose that its metal layer is chromium.

27. Fang teaches use of chromium metal layer ("UBM"; 308; Par .0029).

28. Because use of chromium is known in the art for providing underlying metal layers, it would have been obvious to one ordinary skill in the art to select the claimed material, since it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination. Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

29. Claim 158 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. 6,013,571) as applied to claim 151 and further in combination with Hozoji et al. (U.S. 2002/0079575).

30. Morrell does not appear to disclose it solder material being tin comprising silver and copper.

31. However, Hozoji teaches use of bumps of tin comprising copper to mount chips (Par. 0104).

32. TiN comprising silver and copper is a known material for connecting chips as exemplified above. As such, its selection would have been obvious to one of ordinary skill in the art, since it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination. Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

33. Claims 161 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. 6,013,571) as applied to claim 151 and further in combination with Ohuchi (U.S. 2002/0033525).

34. Morrell discloses the same invention as claimed including a copper layer over Sn/Pb. This is the same as the claimed invention except that its tin cap comprises lead instead of silver.

35. Ohuchi (Par. 0044) shows that Sn/Pb and Sn/ Ag produce equivalent structures known in the art. Therefore, because these materials are art recognized equivalents at the time the invention was made, one of ordinary skill in the art would have found it obvious to substitute Sn/Ag for Sn/Pb.

36. Furthermore, Sn/ Ag is a known material for providing eutectic solders as exemplified by Ohuchi (Par. 0044). As such, it would have been obvious to one of

ordinary skill in the art to select Sn/Ag as an alternate eutectic solder, since it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination. Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945).

Response to Arguments

37. Applicant contends that his invention is patentable, because allegedly one would not be motivated to a combine a solder mask, because Morrell's solder is small and would avoid flowing widely. Also applicant contends that the obviousness of using SnAg as a solder composition would not be obvious since Morrell and Ohuchi teach forming their solder in different way, Examiner is unpersuaded. Applicant's remarks that since the solder appears small there would be no need for a solder mask are based on mere speculation which is insufficient to overcome examiner's prima facie case. See e.g. MPEP 2145 (The arguments of counsel cannot take the place of evidence in the record. In re Schulze, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965); In re Geisler, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997) ("An assertion of what seems to follow from common experience is just attorney argument and not the kind of factual evidence that is required to rebut a prima facie case of obviousness."))

38. Added protection of underlying layers, as well possible solder damage due to misalignment during reflow are known to occur in the art. Moreover, as shown in the newly cited art as exemplified in (U.S 20020053745) a mask can be used for other purposes such as alignment of devices. Simply, because there a small amount of solder contacting pad does not mean that there is no reason to use of solder mask. As

illustrated in Marrs (U.S 6,164,463) in Figure 8, the use of small contacts with solder mask are known in the art.

39. Secondly, Ohuchi was not relied on for its depositing step, but only for the limited purpose of showing that the SnAg is a known solder composition in the semiconductor art. In addition, irrespective if the two references use two different depositing techniques, either one is known to be capable of forming SnAg as exemplified in cited Hsieh et al. (U.S 2002/0180062).

Conclusion

40. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMES M. MITCHELL whose telephone number is (571)272-1931. The examiner can normally be reached on M-F 8:00-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mathew Landau can be reached on (571) 272-1731. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew C. Landau/
Supervisory Patent Examiner, Art Unit 2813

July 27, 2010
/James M. Mitchell/
Examiner, Art Unit 2813